

Time dissolving the grosser Salts, and fitting them to be carried off through the Urinary Passages.

These Waters have been found of excellent Avail in many other Illnesses, besides the Scurvy and Evil: But I forbear mentioning any other Cases, lest I trespass against good Manners, by making my first Visit too long. I am with all due Respect,

S I R,

Your very humble and obedient Servant,

Holt, Dec. 16.

1728.

John Lewis.

III. *A further Account of a new Machine, called the Marine Surveyor, designed for the Mensuration of the Way of a Ship at Sea, more correctly than by the Log, at present in Use, or any other Method hitherto invented for that Purpose. By Mr. Henry de Saumarez, of the Island of Guernsey, Part of his Majesty's antient Dutchy of Normandy.*

HAVING given an Account of my Projection for ascertaining the Run of a Ship at Sea, which has appeared in the *Philosophical Transactions* of the *Royal Society*, Vol. xxxiii, for the Months of *November* and *December 1725*; as also in those for the Months of *March* and *April 1726*;
2
and

and having been since frequently employed in making Experiments thereof, and Improvements thereon, I take Leave to add what follows as a Supplement to those Discourses on this Invention, which I am humbly of Opinion may, in Time, prove of great Use in those extensive Branches of our foreign Commerce, wherein so many of his Majesty's Subjects are concerned.

At my publickly setting out on this Invention, I had his late Majesty's Leave several Times to have a Boat on the Canal in St. *James's Park*, where the Shallowness of the Water was such, that it would not admit of my using the Iron Fork, the Weight of which may be about four Pounds, and which I have described in the *Transactions* afore-mentioned; and therefore I was obliged to fall on some Expedient to answer my Purpose in such a Depth of Water. Various were my Designs to this End; however at length I fixed such a Machine to my Boat, as had an equal Number of Revolutions in a measured Distance of 2000 Feet, even though the Boat went swift or slow; of which the Reverend Dr. *Desaguliers*, and some other Mathematicians, at Times, were Witnesses. As I did not describe this Instrument in the former Account of my Machine, where it seems to lie blended with that of the Fork, I shall give a Description of it here in the following Figures, *viz.*

In the First of these Figures, F represents my Boat on the Canal in St. *James's Park*, through the Rudder of which a small Spindle passes (in an Iron Pipe) of which H G is the Length. To the Point G are fastened the four Iron Fins, or Flyers, A, B, C and D, in the Form of a Square, the Bars D B and A C, to which they are fixed, lying in an horizontal Position. These Flyers are so contrived as to have full Play in any Motion of the Boat. To the Point H, which is the upper Part of the Pipe and Spindle, is fixed the Dial E: Now the Boat being put into Motion, the Flyers move accordingly, which proportionally affecting the Spindle, the Motion is thereby communicated to the Dial, which may be fitted to strike the Miles or Leagues that the Vessel runs.

But to describe the first Movement of this Machine more exactly, *Fig. 2.* represents it unfixed. The Cross, or Bars D B and A C, as I said before, lie flat, or in an horizontal Position; the Arbor or Spindle, which is perpendicular thereto, screws into the Point G, and passes through an Iron Pipe to the Dial, in manner aforesaid. The Flyers A, B, C and D being fitted to move in any Motion of the Boat, the Bars are accordingly affected. This Instrument is so contrived, that two of the Flyers on one Side shall always resist the Water in the Motion of the Vessel, whilst the other Two give Way in their Turning. The resisting Flyers in this Figure are A and B, and D and C will be the same when they come into their Position; for they resist and give Way alternately so long as the Motion continues, which is always circular; and so truly does it revolve, that

H

be

be the Motion swift or slow, in any measured Distance, the Number of Revolutions will be equal.

This is the Machine which I first tried on the Canal in St. James's Park, and with this it was, that I made my Observations on the Tides in the River Thames, as they appear in the *Philosophical Transactions* for the Months of *March* and *April* 1726; which I chose the rather to do, in regard I found it to answer very well in all my Experiments. And I am yet of Opinion, that it would be an useful Instrument to determine the Strength of the Tides on our Sea Coast, which if marked in our Charts, might prove advantageous to our Commerce. But considering, that though this Projection might be serviceable in Barges, Pleasure-Boats, or other Vessels, in fair and moderate Gales of Wind, yet it might prove useless in boisterous and stormy Weather, and in long Voyages, when it might be choaked with Weeds; I therefore fixed to my other Invention the Fork, which is contrived in such a Manner, that I will even yet be so bold as to affirm, it shall determine the Ship's Way in a Storm, or when she is scudding before the Wind, when the *Log* is incapable of it. As the Canal would not allow me to try, with any Certainty, my Iron Forks there, I was obliged to have some made of lighter Materials, which seemed to answer somewhat near the Truth, and made me so sanguine as to believe, that they would have an equal Number of Revolutions in the same Distance, even though the Motion of the Boat was swift or slow between Mark and Mark. I must here do my worthy Friend Dr. Desaguliers (who frequently honoured me with his Company in the Experiments of the
aforesaid

aforesaid Invention) the Justice to own, that he dif-
fented from me in this Particular, in regard he said the
Forks muft have different Pofitions, according to the
Velocity of the Veffel to which they were fixed, and
confequently could not have an equal Number of Re-
volutions in fwift and flow Motion.

Whilst I was confidering where to carry on my
Experiments to prove the Verity of my Inftrument,
and to answer this Objection, I had the Honour
to be introduced to the late ingenious *Samuel Moly-
neux*, Efq; whose Memory will always remain dear
to me. As he was ever ready to encourage all lau-
dable Defigns, and particularly fuch as were calcu-
lated for Publick Good, he foon became my Patron:
And as he was then one of the Lords Commiffioners
of the Admiralty, and my Machine fell within his
Province, he exprefs'd a Defire to fee an Experiment
of it on the River *Thames*: Accordingly I fhew'd to
him, and feveral of the principal Officers and Com-
miffioners of his Majesty's Navy, the Nature and
Ufe of it between *London* and *Woolwich*, when he
feemed to be of the fame Opinion with Dr. *Desa-
gulier*s, viz. Whether in a certain Diftance, and in
different Motions of the Veffel, the Inftrument could
revolve equally. Hereupon he advifed me to take a
Trip over to *Holland*, and to try my Machine with
the *Log*, in my Passage; as alfo thoroughly to examine
the Truth of his Objection on the long Canals in
that Country, where there was little or no Tide or
Current.

Accordingly I had Orders to embark on Board the
William and *Mary* Yacht, which was ordered to
carry over the Lady of Count *Welderen*, one of the

then *Dutch* Ambassadors at our Court, to compliment his Majesty on his Accession to the Throne. My Machine being fixed at the Stern of this Vessel, we kept her Run both by it and the *Log*. On the nicest Calculation, in our Passage over, the Difference between us was 2 Miles and 2640 Feet: At this I was in no wise surpris'd; for as I knew the *Log* to be very erroneous, and I undertook to correct the Errors of it by my Instrument (in the Truth of which I might then be too forward, as too many are on such Occasions) I was assured we could not agree; and therefore I charged the Difference accordingly.

Among the considerable Company on board the Yacht, we had a curious Gentleman, Captain *Lynslager*, Commander of one of the *Dutch* Men of War, who seem'd not a little pleas'd with my Contrivance; and no sooner did he land in *Holland*, but he spoke of it to some Gentlemen of the highest Rank there, whose Curiosity induced them to desire to see an Experiment of this Invention: Accordingly I was sent for to the *Hague*, and on the Canal there, before Baron *Hop*, Baron *Wassenaar*, Admiral *Somelsdyk*, Mr. *s'Gravesand* (Professor of the Mathematicks in the University of *Leyden*) Captain *Lynslager*, &c. we run a certain Distance in swift and slow Motion, in order to see if the Instrument would have an equal Number of Revolutions therein. In running up, it revolv'd 2300 Times, and in coming down 2060. Here then was enough to convince me, that Dr. *Desaguliers*, and Mr. *Molyneux*, had judg'd truly of the Fork, and more especially since the learned Mr. *s'Gravesand* joined in Opinion with

them; who notwithstanding encouraged me, by telling me my Labour was not in vain, for that the Instrument might still be of good Service, by making Tables to rectify the different Revolutions.

An Opinion strongly indulged is rarely parted with; the Truth of which I find in my self; for although Dr. *Desaguliers*, Mr. *Molyneux*, and Mr. *s'Gravesand* did jointly agree as to this Invention, yet still did I entertain some slender Thoughts, that it must answer the Purpose, in the Manner I had proposed. For when I considered, that I had two Fathom of Rope out on the *Dutch* Canal, which was but 5 or 6 Feet deep, and that the Fork of my Machine weighed about three Pounds, or three and a half, and was two Feet and a half in Length, I thought it not unreasonable to suppose, that its Weight, in the slowest Motion of the Vessel, might occasion it to strike Ground, and consequently impede its Motion, and lessen the Number of Revolutions as above. Of this I had been fully satisfied whilst in *Holland*; but fearing to lose my Passage in the Yacht, on Board of which I had embarked by Order of the Lords Commissioners of the Admiralty, I was obliged to hasten over.

Not long after I came to *England* died my worthy Patron Mr. *Molyneux*, in whom all Men of Learning and Ingenuity lost a Friend; and as there was now but little Hope of my going over to *Holland* in the Manner I had done before, I was notwithstanding resolved to take that Journey at my own Expence; and accordingly did so, where I no sooner began my Experiments, but I was convinced of the Truth of the Objections of the three
learned

learned Gentlemen afore-mentioned, which is plainly made appear from the following Figure, wherein the Position of the Fork, in five different Motions of the Vessel, is represented. See Fig. 3.

This needs no Explanation, for it plainly appears, that the Pallets will be more or less affected by the Resistance of the Water, according to the Position they are in ; and therefore the Revolutions in a swift or slow Motion, in the same Distance, cannot be equal.

Being now fully persuaded, that the Fork would not revolve equally in the same Distance, and in different Motions of the Vessel, I now began to repair this Defect by calculating some Tables, which render it still a very useful Instrument. On what Foundation I formed these Tables, there will be no need for me to mention, since I shall go on to shew what further Improvements I have made of this Instrument, and that it is now every Way useful without them. And this, I think, I cannot better do, than by entering here the Extract of a Letter to Dr. *Desaguliers* from a learned Mathematician in *Holland*, whose Company I was honoured with several Times, whilst I was making my Experiments on that Side, viz.

“ Mr. *De Saumarez* having desired me to acquaint
 “ you of the Success of the Experiments, which I
 “ have seen him make of this Machine, for the measu-
 “ ring the Way of a Ship in the Sea, it is with Pleasure
 “ I undertake it, since I am fully persuaded you
 “ will not be wanting to contribute all in your Power
 “ to promote an Invention so useful and advantage-
 “ ous as this is.

“ The

“ The first Experiment that I attended was with an
 “ Iron Fork, such as the Gentleman himself hath de-
 “ scribed in the *Philosophical Transactions* of the
 “ *Royal Society*; when the Number of Revolu-
 “ tions were more in the swift than in the slow Mo-
 “ tion of the Boat, whereon we tried this Instru-
 “ ment. This I take to be owing to the different
 “ Inclinations of the Machine; which were more
 “ Horizontal, according as the Motion of the Boat
 “ was more swift; from whence we concluded, that
 “ it would be necessary to help this by some Ta-
 “ bles calculated for the Purpose: Since which, Mr.
 “ *De Saumarez* hath accordingly formed such Tables;
 “ but as I was not present at the Experiments where-
 “ on they are founded, I leave you to the Gentle-
 “ man himself to give you an Account thereof.

“ I have also made another Experiment with Mr.
 “ *De Saumarez*, upon a new Correction of his Ma-
 “ chine, which he will better explain to you, when
 “ you see him, than I can describe. Here he has
 “ contrived the first Movement of his Machine to lie
 “ Horizontal under the Water; and such was our
 “ Success in this Experiment, that I make no more
 “ doubt of the Usefulness of this Invention, which
 “ I look upon as very advantageous to Navigation;
 “ since the Number of Revolutions here scarcely
 “ differed 4 in 332 in the different Velocity or Mo-
 “ tion of the Boat: But this I must observe, that
 “ the Number of Revolutions here were greater
 “ when we moved most slow. For my Part, I do
 “ not question, but that by a small Correction, the
 “ Number of Revolutions may be always rendered
 “ proportional to the Distance; yet let us make no
 “ Hypo-

“ Hypotheses ; for Experiments of this Machine,
 “ wherein may be had some Millions of its Revo-
 “ lutions, will perfectly shew the Use that may be
 “ made thereof. In the Interim I believe, that Mr. *De*
 “ *Saumarez*’s Invention may be, nay, ought to be,
 “ especially with this last Improvement, *infinitely*
 “ *preferred to all other Methods for ascertaining*
 “ *the Way of a Ship in the Sea, &c.*

Here then you have the Opinion of a learned Gentleman of my Improvement on this Invention, whose Eminence among the *Literati* is such, that this alone might give a Sanction thereto. It is here observed, that the Difference in the Revolutions of my Machine, on this new Method, was scarcely 4 in 332 : Who then can say this Difference was not owing to the different Sheers in our Boat on the Canal? But I shall not go about to determine this, it remains for me now only to shew the Improvement which I made of the *Marine Surveyor* whilst in *Holland*, which is hinted at in the Letter above, and which is now brought to such Perfection, that I persuade my self no very material Objections can be brought against it. The following Figure shews this Improvement, wherein the Objections of the different Inclinations of the Fork are now entirely removed. See Fig. 4.

A F G H is the Fork, in the same Form as the Iron Fork described in the *Philosophical Transactions*, Vol. xxxiii, for the Months of *November* and *December* 1725, which differs from the other only in the Materials of which it is framed ; this being contrived of such as to make it equiponderous with the Water, and to lie in an Horizontal Position,

fitting, even though the Ship or Vessel to which it is fastened be at Anchor, or under Sail. H B is a Rope, of a convenient Length, fixed to a Screw or Worm at the Point B, which goes about 6 Inches into an Iron Pipe, of which B I is the Length: Through this Pipe an Iron Spindle passes into the aforesaid Screw or Worm to which the Dial C is fixed; as soon then as the Vessel moves, the Fork plays in an Horizontal Position, which moving the Spindle within the Iron Pipe, the Motion is thereby communicated to the Dial, which is fitted to strike to the Miles or Leagues the Vessel runs; and let the Vessel move swift or slow, the Pallets A and F are equally affected, and consequently must measure the Distance sailed to a greater Exactness than the Iron Fork is capable of in the Manner I have described it in the *Philosophical Transactions* aforesaid. For want of better Conveniencies when in *Holland*, I had this Iron Pipe fixed to a thin Board, which I fastened to the Rudder of the Vessel D E; but as I am now falling on a properer Method to fix this Iron Pipe, &c. which I could not well do in *Holland*, since the cold Weather was so far set in, that it would not allow me to make more Experiments than I did on that Side, I hope soon to make it appear, that the Revolutions are exactly equal in this new Improvement of the Fork.

Here then do I offer what I humbly conceive cannot fail being of Service to the Community of which I am a Member, as well as to all the Maritime Powers. 'Tis the Fruit of several Years Study; for my Thoughts were first employed on it, when the Nation felt so great a Loss as it did in the unhappy

Fate of Sir *Cloudeſly Shovel*, &c. ſince which Time (from the Numbers of Workmen I have employed, the various Alterations I have made, and the great Variety of Experiments carried on at my own ſole Coſt and Charges) I have been at no ſmall Expence; inſomuch that my Eſtate has felt the Weight thereof. However, it is ſome Satisfaction to me, that I have brought it to the Pitch it is now at, where I cou'd wiſh to ſee the Publick take it up, and have it tried by competent Judges againſt the *Log*, the Errors of which I have amply ſet forth in a former Diſcourſe. This, methinks, is what I might reaſonably hope for, ſince, as I ſet out with honeſt Views, in a praiſe-worthy Undertaking, I ought (to uſe the Words of a conſiderable Author on this Head) to meet with Aſſiſtance in the Beginning, with Encouragement if I ſucceed, and even with Pity, if not Praiſe, although I ſhould fail.

I am well aware, *that he who decries an old Cuſtom, ſeldom meets with Succeſs, even though what he advances againſt it may be very reaſonable.* This ſeems to be the Caſe between the *Marine Surveyor* and the *Log*; for the latter having been long in Uſe amongſt the Seamen, it may be with Difficulty the former will be received; which probably I may not live to ſee, ſince, as I am now bending beneath the Weight of Age and many Infirmities, I cannot be far off bidding Adieu to the Things of this World; and when I ſhall make my *Exit* from it, God grant ſome happy Genius may raiſe a good Structure on the Ground-work which I have here marked out: And I am the more earneſt in this Wiſh, becauſe I am firmly of Opinion, that

that what is here advanced, if rightly conducted, cannot fail of proving highly advantageous to Trade and Navigation.

January 23^d,
1728-9.

Henry de Saumarez.

P O S T S C R I P T.

In a former Discourse on this Invention, and which appears in the xxxiii^d Volume of the *Philosophical Transactions*, I hinted that I was upon making a further Improvement in Navigation, whereby I propos'd to make a Ship work far better to Windward, than it is possible for the most Weatherly one to do at present; as also to make them tack and ware in much less Room than is generally done on such Occasions. The Advantages arising from such a Projection, if it proves practicable, must be considerable; for

1. The Ship which is in Danger of a Lee-Shore will hereby be enabled to weather the Point she may want, and not be forced, in stormy Weather, to anchor in the very Breach of the Shore, and even in the Jaws of Destruction. Of this we have had too many melancholly Instances, where several Lives and Fortunes have been lost; Disasters of which kind, it is humbly conceived, may, in a great Measure, be prevented by this Invention.

2. Hence we need not fear to get the Weather-gage of an Enemy; for by plying to Windward much faster than he can, and by tacking and waring in much less Compass, I can either leave him, or continue to engage him, as shall appear most convenient: At least I can so spend the Day, as to be able to secure my self under the Covert of the Night; or if

I chance to be near the Land, I may hereby be enabled to gain a safe Harbour.

3. By this Invention the wild Steerage which is too frequently made in some Ships, will be prevented, which all Mariners must allow to be of Service, especially in chasing, or being chased by an Enemy; as well as in their keeping the Reckoning of the Ship's Way, &c.

I might here touch on other Advantages arising from this Project, which I omit at present, since as I am about preparing some small Models to shew the Nature of this Contrivance, they will fully appear therefrom: And if what I offer should not be so practicable in large Ships, as it were to be wished, I yet hope some happy Genius will, in Time, so far improve on what I shall hint, as to make the same serviceable to my Country.

When I consider, that to Navigation *Great Britain* owes its Riches and Strength, it certainly ought to have the Preference to all other Arts and Sciences; and therefore any Improvement therein surely cannot fail of meeting with Regard; more especially where such desirable Ends are proposed, as a Method to prevent Ships being wreck'd on Lee-Shores, as also a Means to facilitate the Escape of them, when too powerfully attacked by an Enemy; or leading them to Victory, where they have any Prospect of it, &c. As hereby Honour may accrue to the Nation, and the Lives and Fortunes of several People may be saved, I only desire publick Experiments may be made of these my Machines, on the Proof of which I am willing to stand or fall.

H. D. S.

IV. A

Fig. 1.

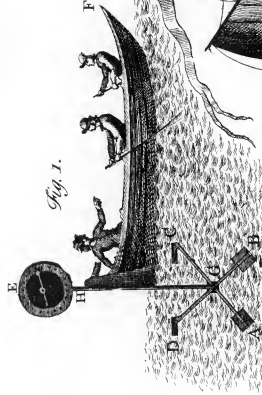


Fig. 2.

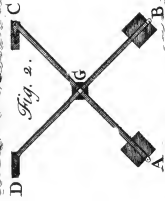


Fig. 3.

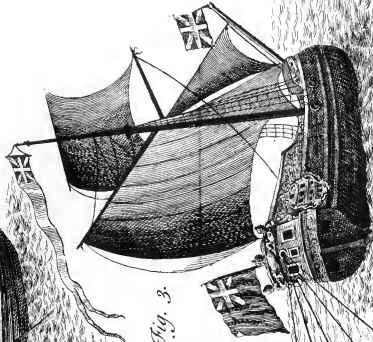


Fig. 4.

